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## **Behaviour of ITER flowmeters under operating conditions: simulation and experimentation**

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CEA/SBT has to deliver 277 flowmeters for the control of the ITER superconducting magnets. Some of the flowmeters will operate at room temperature while the remaining ones will operate at cryogenic temperature (5 bar and 5 K, typically). Within the framework of this contract, CEA/SBT has to measure the flow coefficient of the flowmeters that takes into account the fact that the fluid is not completely incompressible and that the pressure drops are not equal to zero. As the use of supercritical helium involves very high Reynolds number, this coefficient was chosen to be measured in the Helios loop coupled to the 400 W @ 1.8 K refrigerator available at CEA/SBT. Since all the refrigerator cooling capacity is absorbed by the cold circulator while characterizing the largest flowmeters, an optimisation of the loop was required in order not to add any electrical heater even if the operating temperature of the loop has to be higher than the temperature of the helium bath of the refrigerator. This optimization allows the whole cooling capacity to be dedicated to the circulating pump in order to maximize the mass flow rate in the flowmeters. The design of the loop was carried out with an EXCEL model resulting from a thorough work. In a second time, a model made with the Simcryogenics library for MATLAB/Simulink was used. The latter demonstrated a great ability (compared to the model made with EXCEL) to solve the problem and the results obtained were compared with those obtained with the EXCEL model. Finally, the results of these simulation tools were compared to the experimental results.

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